The Xtal Set Society Newsletter

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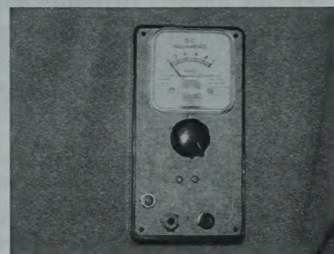
Jumpin' Joseph Henry
Measuring Inductance with one transistor

By James T Hawes, AA9DT

SIMPLE SIMON. Wow, an inductance meter that only requires one transistor!

While researching articles on the Web, I discover Jim Clack's *Henryometer* inductance meter project. Clack's article appears in the December, 1972 issue of *73 Amateur Radio Today* magazine. The schematic in the article contains errors and omissions, but seems like a "fixer-upper." The circuit is a Hartley oscillator, a rectifier, and a meter: *Simple Simon.* (*Problems*: The measurement circuit and a floating ground are particularly confusing. There are no details about the oscillator frequency. The "CAL" pot is missing from the schematic. The article provides no pot value. The oscillator frequency, oscillator coil value, and transistor type are absent.)

SNAKE OIL. I should have become suspicious when I read the snake oil: "Most any transistor will do!" (So: Which device should I use? With what characteristics? Germanium? Silicon? GaAs? A lot of gain? A little?) Sherlock AA9DT takes up the case: Hmmm. The device in the article is a PNP type. From the article's year, we can surmise that the device must be germanium. Yet the bias network is missing. The transistor base seems to float between Vcc and ground. But *where* between Vcc and ground? The schematic provides a floating ground symbol, but no resistive divider!



The nearly completed meter

SPURIOUS? I breadboard the circuit. But try as I might, no version of my circuit can measure anything. All inductors appear as shorts. But when I measure my oscillator's output with a freq counter, I see an indication. A riddle, Watson: How can the circuit work if it doesn't measure? Answer: Maybe the signal's too weak. Or spurious.

UNCLE PHIL graciously offers his insights, and even tries a few circuits himself. Thanks and 73s, Phil! But the "Henryometer" as a direct-reading inductance meter remains elusive.

RESTART. I start over. I try various oscillator circuits until one causes an *unmistakable* reading on the freq counter. I also change the measuring diode to one that I *know* is a 1N34A. (NOS germanium part from my junk box.) The 1N34A is one point that *73* author Clack is adamant about: No substitutions! Except in my new circuit, a Colpitts, the measurement diode bypasses the meter. In the original circuit, the diode is in *series* with the meter. (I try Clack's wiring, but can't make it function.)

LOOP-DE-LOOPSTICK. I decide that I need to know the "right" frequency. Uncle Phil guesses 1 MHz. I try that, plus 800 kHz and 500 kHz. Clack's article calls for a loopstick in the oscillator. Maybe the L-C formula will lead me to the frequency. Nope. My research tells me that several loopstick types exist. I

find values from about 150 to 680 μH! I decide to use the only inductor that *Radio Shack* sells, a 100 μH coil. It's a bulky coil, but it fits on my PC board. *(Miniature coils should work equally well.)*

MEASUREMENT RANGE. Clack mentions the meter's measurement range, 200 μH to 10 mH. Did Clack make an error about the 200 μH? To read 10 mH on the left, 2 *millihenries* might max out the meter on the right. This guess turns out to be wrong. (I'm not taking into account that the meter is nonlinear. The left reading is *infinity.*)

METHOD TO MADNESS. I'm more interested in 2 mH than 200 μH. I decide to set the top meter reading to 2 mH. That will allow me to measure 2.2 mH, a standard value. I start to envision a formula. The coil should allow 1 mA to flow when I reach *some frequency value.* Rearranging the reactance formula, I find that the frequency should be 358 kHz. The 2.2 mH measurement point would be not quite full scale on the milliammeter. (Smaller values allow more current flow.) Here's the process…

Calculate Inductance Meter Frequency	
➔1. Figure reactance (X_L) for unknown coil L_X: [(9V / 2) / 0.001]= 4,500 Ω	
➔2. Plug values into inductance formula: X_L= (2 x π x F x L)= (6.28 x F x 2)	
➔3. Solve for F: F= [X_L / (6.28 x 2)]= (4,500 / 12.56)= 358 kHz	
Where...	
• F denotes frequency in kHz. • kHz denotes kilohertz. • L denotes inductor value in μH.	• Ω denotes ohms. • μH denotes microhenries. • V denotes volts. • X_L denotes coil inductance in ohms.

SUCCESS. I wire everything up for the hundredth time. Allowing for parts tolerances, the oscillator runs at a little below the estimated 350 kHz. At last, readings for different coils differ as they should. Soon I can measure 2.2 to 10 mH. The measurements at the right side of the meter are quite distinct from one another. I can plainly make out 2.2 mH, 3.3 mH and 4.7 mH. Ho, ho ho! There is a Santa Claus!

LOGARITHMIC CABIN SYRUP. The divisions between test values (pie slices between measurements) *aren't even.* Each larger value draws closer to its neighbor. In fact, larger *(left-side)* measurements are extremely close to one another. I suspect that meter resistance is an ever larger part of the reading. "Aha!" I murmur. The measurement circuit is *logarithmic*, not linear.

Operation notes
About The Inductance Meter

The inductance meter really is an "AC ohmmeter," just as Jim Clack describes it: Right down to the left-deflecting needle, nonlinear scale, and "CAL" (zero) pot. The left side of the meter is strictly for comparative purposes. Yet the right side is quite useful! At last you can sort out that drawer full of assorted ham fest bargains!

Though this meter acts like an ohmmeter, the meter *measures inductive reactance,* an AC quantity. (Smart readers will observe that the same meter could also measure capacitive reactance. But a meter with a *useful range* would likely require circuit changes. I'll leave these changes to readers.)

The Meter Face

As with an ohmmeter, the inductance meter operates from right to left. Small inductance values appear at the right side. Values increase toward infinity on the left. (Here, "infinity" means a value beyond the meter's range.) The meter scale is logarithmic. The greatest separation between inductance values occurs between 0.5 mA and 1 mA. Here are some typical readings from my meter...

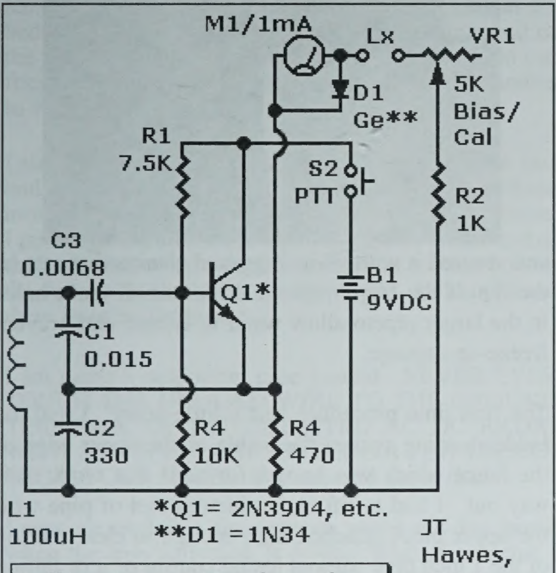
Reading	Inductance
0.700 mA	2.2 mH
0.475 mA	4.7 mH
0.425 mA	10.0 mH
0.400 mA	20.0 mH

Operating The Meter

For accuracy, every meter reading starts with calibration. Before you use the meter, zero it: Short the meter leads while adjusting the pot until the meter reads 1 mA. The 1 mA setting is equivalent to about 2 mH. Calibration compensates for falling battery voltages and different transistor gains. After calibration, touch the meter leads to the leads of the device under test. Now read the meter.

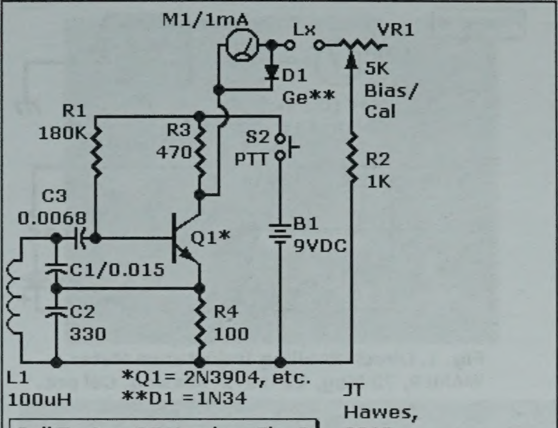
The Transistor

For the meter circuit, use a type 2N3904 or equivalent *silicon* transistor. (Equivalents include: 2N2222A, PN2222, 2N4124, 2N4401, some BC547, BC557, etc.) Ideally the chosen device should have a gain near 200. Some transistors require adjustment of the base resistor. You can make the circuit less sensitive to different transistor types by *replacing* the base resistor: A two-resistor bias network allows use with more transistor types. *(Please see the schematic, Figure 3.)*



Coil Tester, EF Version, *Fig. 1*

Figure 1 is a common-collector circuit *(Colpitts oscillator)*. It's stable and has a high-impedance input.



Coil Tester, CE Version, *Fig. 2*

Figure 2 is a common emitter *(CE)* version of the circuit. I *recommend* building this second version. It has a medium impedance input. Due to loading on the LC tank, this circuit might be the stabler one.

Two-Resistor Bias

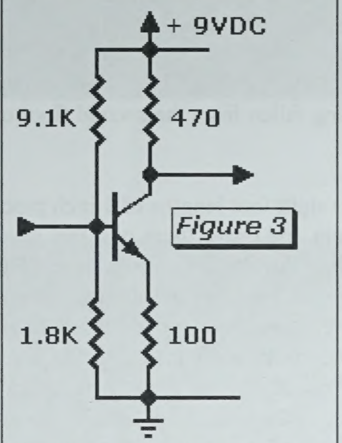


Figure 3

Figure 3 is the recommended circuit for two resistor bias. On Figures 1 and 2, builders might have to adjust the base bias resistors for best operation. There's only one base resistor in the CE circuit. This one resistor allows easy adjustments. Yet a two-resistor bias circuit would be more stable. Substitute the base resistors in Figure 3 for the base resistor in Figure 2.

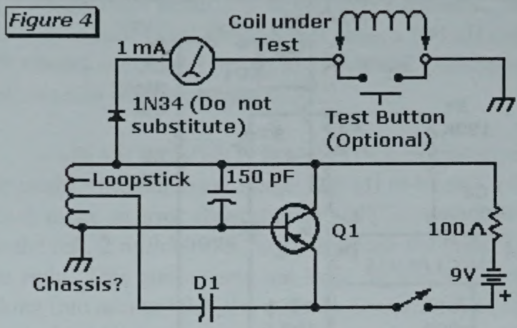


Fig. 1. Direct-Reading Inductance Meter. WAMLP, 73 Mag, 12-1972. Missing: Cal pot.

Figure 4 is a retouched scan from the Clack circuit. Please don't build this circuit because it's incomplete. In my tests, the original Hartley oscillator *doesn't* produce a useful signal. Also, the Clack circuit requires *five times* more current than do my circuits. Let's preserve that battery!

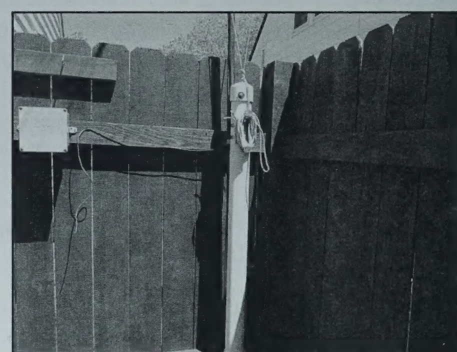
A Pipe Dream Antenna
by Ken Ladd

I wanted a receiving antenna but was faced with some limitations.

1. It had to fit into the fenced back yard and look decent.

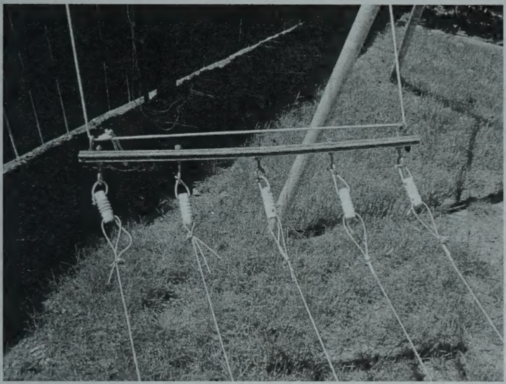
2. I did not want any real high work especially since having fallen from the second floor on a ladder before.

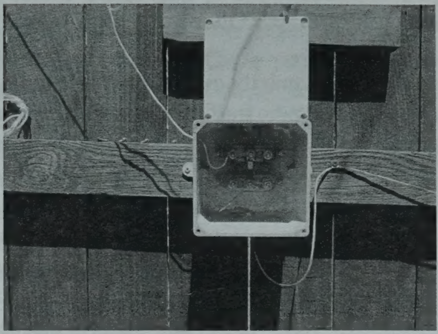
I took two eight foot lengths of 1 inch pipe, threaded a cap on them and drove them two feet into the ground tight against the 2/4 cross members of the six foot Cedar fence. I secured them to the 2x4's with conduit clamps. I removed the cap and threaded a 1 inch coupling on each of then I then constructed two ½ inch pipe mast about 13 feet long. I made two spreaders using tees, elbows and nipples and secured them to the lengths of pipe. I threaded a loop of small Nylon rope through the pipe spreader and two eye bolts. As I lifted the uprights above the 1 inch pipes my wife slid a three foot length of 1 inch pipe onto the ½ inch upright from the bottom and guided the ½ inch pipe down into the larger pipe. I did learn that a ½ inch black pipe coupling slides freely through black pipe but not all galvanized pipe. Once that was in place we threaded the two 1 inch pipes together. We then extended the ½ inch pipe as much as we could without too much sway



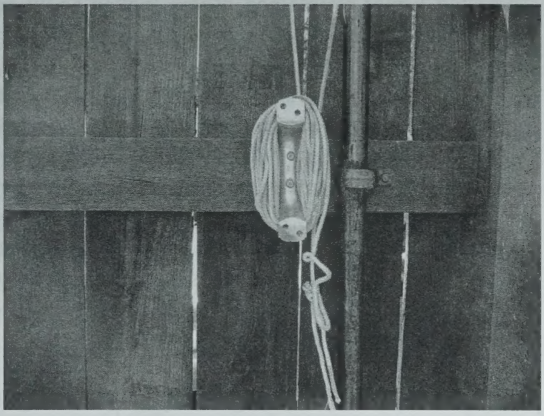
and secured it with ½ inch ground clamps that rest on the top of the larger pipe. I drilled small drain holes in the larger pipeto allow water to escape and prevent freeze-up damage.

The first time procedure was a little scary. I had the ladder leaning against the inside of the upper edge of the fence which was known for nails that work their way out. I had to lift about thirteen feet of pipe with the upper piece attached high enough to clear the top of the 1 inch pipe without losing control of it or falling off the ladder on top of my wife. Oh what she puts up with! We had to do it another time after a massive Maple branch took it down. In my haste I had forgotten to move our cars out of the driveway. Could have been bad. The last time I set the entire mast assembly by myself like a pole vaulter after lining to bottom up with the hole in the ground.



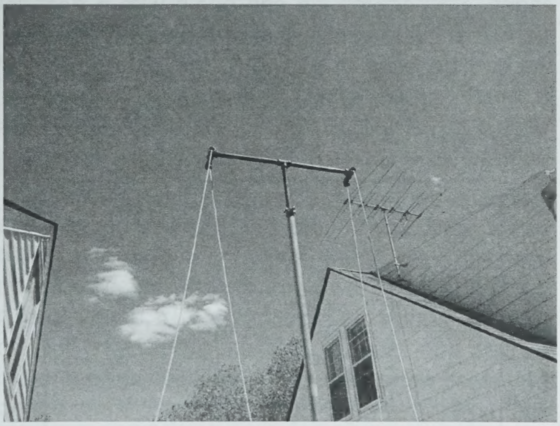


I took two 24 inch lengths of Spar Varnished hardwood floor strips (the longest I had) that had been pre-drilled and attached five insulators using eye bolts and short lengths of wire. I ran five 50 foot runs of wire. The eye bolts on the Nylon loops were secured to the flooring strips. I mounted two strap handles to the fence cross members upside down and once the antenna was pulled up into place wound the rope around the handles. Most of this design came to me as I lay in my bed. I was at a loss of how to secure the free end of the ropes until I saw an image of the tie down on our friend Pete's boat hence the upside down strap handles to wrap the rope around.



I tied the outside five runs together at the house end and ran a lead in through a short section of garden hose mounted through the wooden basement window frame. I put a lighting arrestor in a plastic box on the far end of the run. I mounted a duplex arrestor in another box on the fence near the house for the dipole. I did not want them in or on the house.

I am using a cold water pipe ground. NEVER EVER TOUCH THE GROUND WIRE TO THE GROUND TERMINAL OF AN UNTESTED AC DC RADIO WITH A NON POLARIZED PLUG A FEW INCHES FROM YOUR FACE!. Enough said about that.



I was amazed that the antenna wires did not break when the tree limb took it down. When I saw that I had forgotten to tighten one of the three foot nipples and that the first row of threads had broken off I wrote it off to luck.

Fast forward to the first heavy wet snow of last year. It went down again with major damage to the pipes but once again the wire did not break but may have stretched. I have since added strain reliefs and a counter weight.

Link Up to Your Antenna
by Dan Petersen, W7OIL

Elmer Oldham sat quietly in the hamshack and listened to the Morse code radio traffic on 20 meters. A knocking at the door and the voice of Mrs. Oldham saying, "Come in, dear." interrupted his reverie. The attic steps creaked with the arrival of The Young Ham. Elmer glanced over and said "Good day to you, youngster! You undoubtedly have a question of great import for me." The Young Ham was a bit flustered but managed to say timidly "Well, yes, I do." TYH, whose name was Robin, was always in awe a bit at the station and workshop Elmer maintained. Robin looked about and started "Mr. Oldham, (Robin wouldn't *dream* of calling him "Elmer") I have a problem with a crystal radio project I am working on. The tuning is all – weird - I can't seem to get two stations to separate. And the tuning is all squished at one end." Elmer asked if Robin had erected the wire antenna to the specs given him and had used a ground rod. Hearing an affirmative answer he grunted, took a sip if iced tea and said "Well, let's dig a bit deeper. The scene fades as we return to our plane of existence and we delve into the mysteries of coupling an antenna to a radio.

Crystal sets and their big brothers, the regenerative set and the reflex radio, usually require an outside antenna to work properly. There are several ways to connect said antenna to the radio, each with their advantages and disadvantages. So perhaps we can begin with a description of a plain-vanilla run-of-the-mill crystal set. As can be seen in Figure 1, the set consists of a tuned circuit, L1/C1 that due to their values should cover the AM broadcast band. The diode detector is a modern "Schottky" diode called an

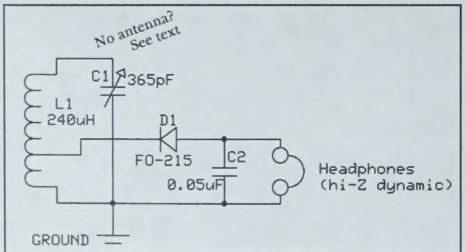


Figure-1 Basic Plain-Vanilla Crystal Set

FO-215. These are very sensitive and are a worthy descendant of the venerable Germanium diode. The diode is connected to a tap on the coil, which reduces the circuit loading on the tuned circuit, thus increasing the selectivity. C2 is an RF bypass capacitor while letting the detected audio proceed to the high-impedance dynamic headphones. I specify those because they have a DC resistance. Crystal earphones can be used but a resistor of about 22,000 ohms needs to be paralleled with C2.

Where's the beef...I mean antenna?!
Those with a Holmesian grasp of minutiae may notice I have not included an antenna with this set. Some sets with a large loop inductor can work without an antenna but those with a "normal" coil (think "toilet-paper tube" size) will not hear anything unless you are standing next to the transmitter tower. So what do you do with that nice wire antenna you just erected?

The Direct Approach.
One of the simplest connections is to connect the antenna to the set as shown in Figure 2. Connect the antenna, slip the "cans" (headphones) on and listen while tuning. WOW! There be radio stations here! Loud! Several of them. All at the same time. All smushed together at on end of the band. What is happening? Before you start disassembling

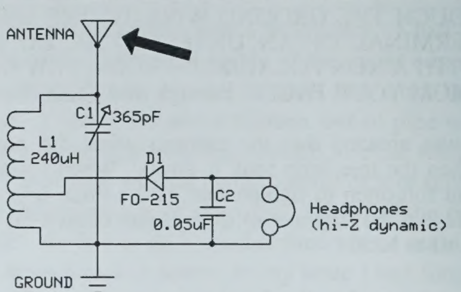


Figure 2 - Now we have an antenna

your set you need to know about what an antenna *looks like,* electrically.

Any antenna electrically exhibits a panoply of exotic electronic terms; resistance, inductance, capacitance to name the most important. An antenna "looks" like a tuned circuit for a particular frequency. The antenna I had on the old farm that I called "The RMS Titanic" antenna was resonant at 1280 Kilohertz. This means if I placed a reactance analyzer at the antenna feed point it would display a pure resistance at 1280 KHz. The capacitive reactance and the inductive reactance cancel each other out, leaving only resistance. So it was *great* at 1280 but would get increasingly reactive either side of 1280. So what you are doing is taking one tuned circuit (antenna) and placing it directly in parallel with the radio tuned circuit. One can only surmise as to the resonance chaos that ensues. This is not really the best way to connect an antenna. Yeah, stations are loud. Together.

Time to tap the keg...I mean coil.

What if we can reduce the effects of the electrical mayhem the antenna places on the tuned circuit? The simplest way would be to connect the antenna to a tap on the coil. Since the coil has only one tap the choice is easy. While it looks like the signal is going past the tuned circuit this circuit is still effective. The resistive and reactive components of the antenna are much reduced allowing the set to tune much better. The antenna is still however a significant portion of the tuned circuit. There is another way to directly connect the antenna to the radio.

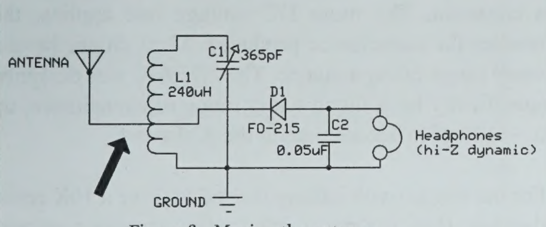


Figure 3 - Moving the antenna

...There is another, Luke...

OK, so those who have never seen Star Wars won't get it. Deal with it. Another way to directly connect an antenna to the radio is seen in Figure 4. The arrow points to Cx, a small value variable capacitor. A small fixed capacitor would work as well but a variable is, well, variable. You can fiddle with it to see what happens. What is adding this capacitor do? Most AM broadcast band antennas electrically look like a capacitor and you are placing a small value capacitor in series with that "capacitor" which we will call "Ca". If you remember, capacitors in series will exhibit a capacitance of product over the sum, Ca*Cx/Ca+Cx. The result will always be *less* than the value of either of the capacitances. So if you have a very small Cx in relation to antenna Ca the detuning effects of the antenna are minimized. If you change the capacitance of Cx the tuning response will change. The smaller the Cx value the better the selectivity of the set. The sensitivity will decrease which is called in the business a "trade-off". One cannot have it both ways, grasshopper. You didn't really want to listen to that crock-jock with a background of the Grand Ol' Opry did you?

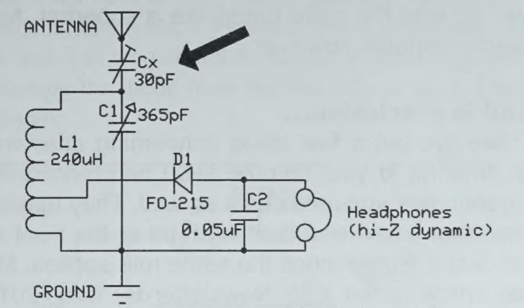


Figure 4 - Antenna capacitive link coupling

Now we Link up.

The last type of antenna is one that is *inductively* linked to the tuned circuit. This is brilliantly referred to as *link coupling*. It took a lot of brainpower to come up with that one. A link coil is, by rule of thumb, 10% to 20% of the number of turns of L1. So if L1 consists of 80 turns of wire I would make the link coil 8 to 16 turns. This can be wound on the same form as L1, right near either end. For tight coupling wind the link coil *over the* top of L1. Convention usually puts it at the ground end of L1.

The link coil is as effective in reducing antenna detuning as the coupling capacitor Cx and if you make the link coil so you can vary its position to L1 you can really play with the sensitivity/selectivity conundrum. Years ago I made a set called the "Son of Litz Blitz" (The XSS Newsletter, November, 2011). I could vary the coupling along a track and the effect on sensitivity was amazing. There was enough radio energy in the "RMS Titanic" antenna (200 feet long, 40 feet in the air)

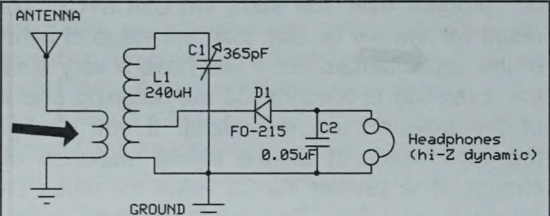


Figure 5 - Antenna inductive link coupling

that I could place the link coil *four feet* away from the set and still pick up stations. The coupling was so light the radio tuned like a superhet. Not exactly portable however.

And in conclusion…

These are but a few ideas concerning attaching an antenna to your favorite set. I had mentioned regenerative and reflex sets as well. They usually have that tuned circuit sitting right at the front of the circuit. Pretty much the same rule applies. My last article in the XSS Newsletter for May, 2016 detailed a set that used a variable link coil in a "Navy Coupler" configuration. This set was also built with a "Cx" coupling capacitor on a separate antenna Fahnestock (FAWN-stock) clip. I noticed at the optimum settings of the link coil and Cx the link coil input was a bit more selective while the "Cx" input was a bit more sensitive.

This is my 73rd article for the Xtal Set Society and since "73" is radio lingo for "best wishes" I shall leave you with that thought. 73, Dan

Revisiting The Varactor Crystal Set

By Phil Anderson, WØXI

Roughly twenty years back - in the early days of the Xtal Set Society – I recall presenting a simple set in the Tid-Bits column wherein we used a varactor tuning diode (also called a varacap) in place of the usual air variable 365 uuf capacitor for tuning. It may be that we used the varactor method of tuning either the Little Sister and/or the Big Brother kits of the day too. Anyway, we received a note from a society member recently inquiring about this method in his copy of Tid-Bits; and, he indicated he'd like to build that design. After a little searching we found the schematic.

Going modern, I redrew the schematic using LTspice on my desktop computer, shown here as Figure 1. The antenna is attached via C2 to the two coils shown, L1 and L2. The purpose of C2 is to reduce the capacitance of the antenna – usually about 1000 pf or more capacitance – down to say 300 or 200 pf. L1 and L2 can be two discrete molded coils or two windings on a single molded core, using today's FT-82-61 ferrite core. Note that C1 doesn't affect tuning since it has such a large value, 0.01 ufd, which is in series with the varacap, which is labeled as Diode D1.

Diodes and transistors can also be used as varactors. When they are reverse biased, a semiconductor barrier develops at the anode which in effect makes the diode a capacitor. The more DC voltage one applies, the smaller the capacitance produced. Most diodes have a small range of capacitance. The NTE618 was designed specifically for a much wider range of capacitance, up to ~ 400 pf to accommodate the AM band.

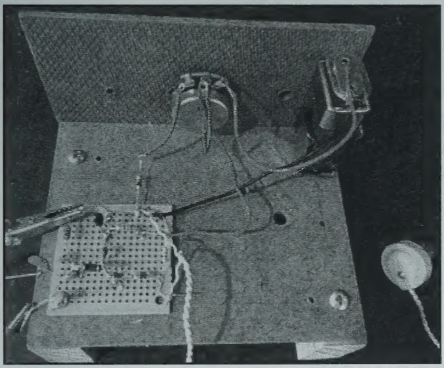
For our set, a 9-volt battery is used to drive a 10K resistive pot. Here the pot is adjusted to provide a voltage from about 1 volt to 9 volts. R1, 150k, is added in series for isolation; thus the voltage at the wiper on the pot also appears at the top of the varacap diode, NTE618.

The NTE618 data sheet indicates the following capacitance of the varacap for the voltages listed:

1.2 VDC (at 1 MHz) provides for 450 pf of capacitance
3.5 VDC provides for 144.2 pf,
6.0 VDC provides for 45 pf,
8.0 VDC produces 20 pf.

As such we can see that the position of the pot sets the tuning capacitance for the LC circuit front end.

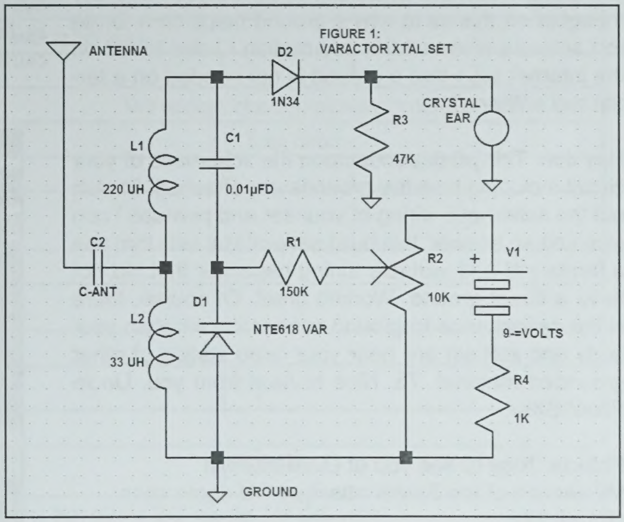
The rest of the circuit is just a standard-forward crystal set. A 1N34 germanium diode is used for the detector and the usual 47K resistor is placed in parallel with the standard crystal earphone.



It's interesting that some of the modern day QRP HF receivers use varactor diodes too. In particular, we see that the ZZRX-40 receiver (from the 4SQRP group) uses a 1N4004 to pull the frequency a few kilohertz when using an xtal. For these HF CW sets the frequency range is limited since the 1N4004 varactor diode capacitance range is small.
If you want to try building the varactor xtal set, be informed that the NTE618 diode – especially designed for the AM band – is still available but only in small quantities. Newark carries them at the current price of $3.11 each.

I, of course, couldn't resist building the old set. I ordered a few of the NTE618s and built it after waiting just three days for mail service. The volume I obtained for our local 500 watt radio station KLWN was about the same whether I used an air-variable cap or the varacap. I haven't tried any nighttime listening yet. Figure 2 shows my scrambled quick build......just a few minutes to put together.

One last point. The NTE618 package looks about like the usual NPN or PNP plastic package, except that it only has two leads, A for anode and K for cathode. The A lead is to the left and the K lead is to the right when viewing the diode from the flat side of the package. Enjoy!



Xtal Corner:Member Correspondence

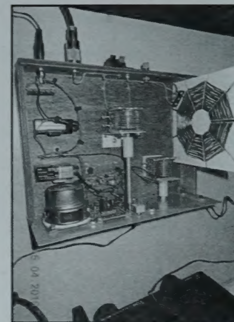
From Joe Winkler
Phil: I have started to work with ferrite rod antennas and have had some good results. Thus far they have been wound with 22 gauge stranded insulated wire. I have a 37 " turn tuning coil and then a 4 turn "pickup coil that feeds the radio input directly connected to the input circuit (transistors). I am interested in trying litz wire instead of the 22 gauge stranded copper wire. If the original plan called for 37 turns of 22 gauge wire, would you use the same number of turns for litz wire or some other number of turns.

Hey Joe : Generally you would use the same number of turns with Litz that you had with your solid wire. Inductance depends primarily on the number of turns. Litz wire has been popular for many years for the AM band since the skin resistance of the coil is less that way. It Litz works that way since it contains a large number of very small enameled wires woven together rather than one #22 enamel wire. Thus the resistance of your coil is much less and hence it's Q as a coil is generally much higher. /Phil.

Also from Joe: Here is something else that is interesting: If I do not connect my earth ground wire to the grounded side of my variable tuning capacitor I get very little reception and what I get is very weak. If I connect my earth ground line to the grounded side of the variable capacitor- tuning, I get good reception and pretty much the whole am band. Do you have any thoughts on this as to why a ground helps on a ferrite rod antenna when all the information I have found on the internet says that a ground is not needed on a ferrite rod antenna?

Hey Joe. This all depends upon the schematic of your circuit including how the grounds are attached. Sketch out the schematic wiring of your set and perhaps I can give you an answer. I've build several xtal sets that use a ferrite rod and variable tuning capacitor that did not have a direct ground. Worked great. Of course, there is the capacitance to ground connection wherein your body and xtal set are near your radio station of other grounded material. 73. Nice to hear from you. Uncle Phil/W0XI.

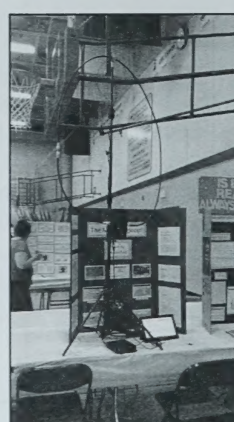
Patricia, Nice to see you at OZARKCON!
My version of the Spider attached.CU again soon.
JIM-KB2XJ

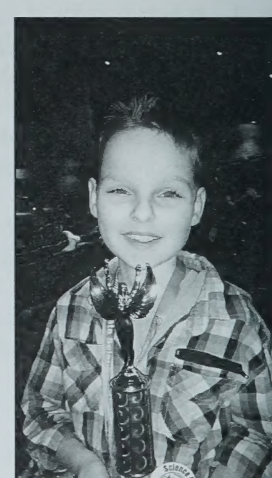


From Martin: Question on Capacitor, 365 air variable with 8:1 reduction drive shaft. Thanks for shipping the capacitors so quickly. My son (KG7OQT) is going to use them for his science project as he is building a magloop antenna. Quick question .. do you know the voltage they can handle ? Martin KG7HAX

Actually, it is not a quick question. See the page from one of our ultrasound articles on our website. In general, the closer the capacitor plates are to each other, the less voltage they will handle. Paschen's Law provides an APPROXIMATION of 327 voltages before sparking/arching with a plate separation of about 20 mils (the distance between plates of our capacitors). You'll have to determine the voltage across the capacitors in your circuit and then approximate the peak voltage. Phil

From Martin
Here are 2 pictures. His name is Dragan and he is 10 years old. He is a licensed General class operator (first licensed as Technician at age 8 and got his general at age 9). His callsign is KG7OQT.





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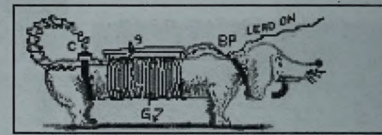

7-5-16

We are dedicated to once again building and experimenting with radio electronics, often—but not always—through the use of the crystal set, the basis for most modern day radio apparatus. This newsletter helps support our goal of producing excellent quality technical books that encourage learning and building. To join the society and receive one year of the bi-monthly newsletter, remit $14.95 to The Xtal Set Society. Canadians, please remit US $15.95. Outside the US and Canada please remit US $21.95.

Please send articles and correspondence to the following address:
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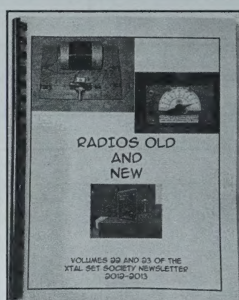
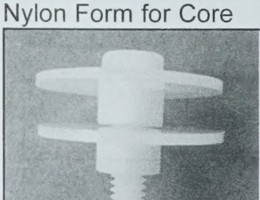


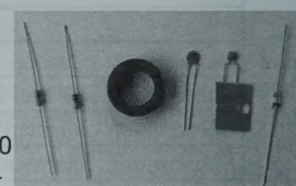
RADIOS OLD AND NEW is volumes 22 and 23 of the Xtal Set Society Newsletter. A wide range of topics and projects are covered in 2012: aerials circa 1917, experiments with regens, grounding and reducing noise in your station, experimenting with spider coils, a 2 for 1 regen set, primer for the 602 mixer at 40 kHz, a modern TRF AM receiver. The following topics for 2013 are: JFET Drain-Output set, a foxhole radio, feedback for beginners, a modern day regen, the universal crystal set, The Albert Hull Memorial Dynatron Regenerative Receiver, adding absorption wave traps, from telegrapher to coherer, a 700 Hz oscillator featuring a quadrature architecture, and more. Vol 23 $15.95

Nylon Form for Core



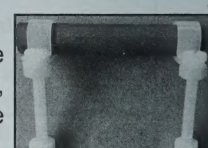
These nylon plastic pieces combine as a form for the various ferrite toroid coils we offer. The form is low loss thus preserving the Q of the coil wound on the form. Extending them above the chassis - which might be metal or fiber board also preserves the coil Q. nycorefrm $2.50

R-L-C-D Assortment



This assortment has nearly all the parts to build a basic am crystal set: 100 pf cap, 330 pf cap, am-band toroidal coil form (ft-82-61), 47k and 100k resistors and a 1n34 diode. RLCD 5.95

Nylon Form for Rod



This set of nylon parts combine as a form for the ferrite rod, thus preserving the Q of the rod mounted above a chassis. The Rod is not included. Nylon Form rod $2.50

Nylon Assortment

This nylon assortment includes two each of the following: 0.25 by 2.5 inch bolts and 0.25 hex nuts; 6-32 by 0.5 inch screw with 6-32 hex nuts and two 6.32 washers; two 0.5 by 1 inch standoffs (with 0.25 through hole, and 0.25 by 1.5 inch standoffs. the latter two can be tapped and connected as a shaft extender for our variable capacitors. Nylassort $3.50